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(54) Name of the invention: Mango Freshness Preservation Method

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Patent Assignee: Dai Ichi Kogyo Company

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Note: Names, addresses, company names and brand names are translated in the most common manner. Japanese language does not have singular or plural words unless otherwise specified by a numeral prefix or a general form of plurality suffix.

Description of the invention

1. Name of the invention

Mango Freshness Preservation Method

2. Scope of the claims of the invention

1. Mango freshness preservation method characterized by the fact that an aqueous solution or an aqueous dispersion of a single polyvalent alcohol aliphatic acid ester or a combination of two or more types of those, is heated to a temperature in the range of 40 ~ 60oC, and the mangos are immersed.

2. Mango freshness preservation method according to the above described Claim 1, characterized by the fact that the polyvalent alcohol is cane sugar, glycerine, polyglycerine or sorbit.

3. Detailed explanation of the invention

[Technological sphere of application]

The present invention is an invention about a mango freshness preservation method.

[Previous technology]

Mangoes are imported in Japan from Southeast Asia, and with the years there has a been a trend of increased imports. Regarding their transportation path, from the harvesting location they are collected into the loading

location, they are classified, and a fumigation is conducted, and after that, they are transported to Japan. However, the above transportation is conducted in open air mainly, and after the harvesting until these reach the Japanese consumers, there is a time period of approximately 5 ~ 6 days. However, most recently, because of the cost reduction of the circulation, there have been many cases where these have been transported by ships, and in the case of the number of days in this circulation mode, it has become necessary to be able to increase the length of the time period to a time in the range of approximately 12 ~ 13 days. Because of that the preservation of the freshness of the mangoes has attracted attention, and at the present time by a low temperature transportation at a temperature of approximately 5oC, the further ripening of the mangoes is delayed, and this circulation mode is the main mode of the technology for the preservation of the freshness of the mangoes at the present time. The method has been considered where the mangoes are harvested at an earlier time, and as they are unripe, in that state, they arrive at the transportation destination. However, at the time when they are transported to Japan, it is necessary that they are fumigated according to the so-called VHT method, and if this VHT fumigation method is conducted on not completely ripe mangoes, the problem occurs that there is a generation of a cavity inside the fruit meat and the circumstances are such that it cannot be said that mangoes where a certain degree of constant ripening has been developed, are to be transported. Because of that, even when they are transported as they are being maintained at a temperature of approximately 5oC, at the time when they arrive at the transportation destination, they have already become over ripened, and together with that there is an occurrence of the accompanying that generation of mold, etc. As a solution measure for that, it has been suggested that after the same VHT fumigation as that for the cooled storage and transportation, the mangoes are made to be in a state where as much as possible there is no development of the ripening process, and there the gas control storage, the film packaging, the wax coating by using natural petrol resins etc. However, in the case of the gas control storage, there is a lot of equipment, and in the case of the film packaging it is manually done and it is difficult and complex, and in the case of the wax coating method, because of the fact that the breathing of the mangoes is completely eliminated, physiological abnormalities of the mangos have been confirmed, etc., and this has not been yet deployed into practical use applications. Because of that, the invention of a simple, inexpensive freshness preservation technology has become a pressing need.

[Problems solved by the present invention]

Taking into consideration the above described, the problem of the present invention is to invent a method for the preservation of the freshness of mangoes that is effective and also inexpensive and where there are no capital expenses incurred, and not only that, but also, that is easy to be practically implemented.

[Measures in order to solve the problem]

The authors of the present invention have conducted and compiled rigorous research in order to solve the above described problems, and as a result from that they have observed that if a polyvalent alcohol aliphatic acid ester and warm water, are used together, they are effective in preserving the freshness of mangos. The present invention is an invention that is based on this observation, and because of that, its essential points exist in the mango freshness preservation method characterized by the fact that an aqueous solution or an aqueous dispersion of a single polyvalent alcohol aliphatic acid ester or a combination of two or more types of those, is heated to a temperature in the range of 40 ~ 60oC, and the mangos are immersed. Here below, still in some more details the development of the present invention will be described.

The experiments for the preservation of the freshness of mangos by a warm water treatment have been conducted in the past. For example, in Pennock and Macdonaldo et al., J. Agric. Univ. P. R. 46 (1962), it has been reported that by immersing mangoes in a warm water at a temperature in the range of 51 ~ 52oC, for a period of 15 minutes, the black spot decease was decreased. However, by using only the method that has been reported in this report, it was confirmed that the black spot decease is decreased, however, it was not possible to slow the ripening of the mangoes, and consequently, it cannot be stated that the effect of preserving the freshness of the mangos was significant. In the case of the present invention, in order to alleviate this drawback point of the warm water treatment, in the warm water a ripening slowing agent is added, and by that it is considered that the effect of the preservation of the freshness of the mangos is increased even further. And it has been observed that as the ripening slowing agent a polyvalent alcohol aliphatic acid ester is effective, and then, it was also observed that, when it is used together with the warm water treatment, by that the elimination of the back spot decease, which has been insufficient by using only the warm water

treatment, is promoted, and then also the ripening slowing effect is increased. And by that, the present invention, was achieved.

(Polyvalent alcohol aliphatic acid ester)

As the polyvalent alcohol that forms the structure of the polyvalent alcohol aliphatic acid ester according to the present invention, for example, it is possible to point out as examples, the following materials: glycerine, D, L-toreite, erithrite, D, L-arabit, ribit, xylit, D, L- sorbit, D, L-manit, D, L-izide, D, L- talid, galactite, arit, maltit, etc., sugar alcohol type materials; or sorbitane, etc., their in-molecule anhydrous materials, or polyglycerine, etc., their polymeric materials; xylose, glucose, fructose, sorbose, maltose, galactose, polysugars, etc. However, in practice, polysugars, glycerine, polyglycerine, and sorbit, are preferred. Also, as the aliphatic acid, for example, it is possible to point out as examples, caprinic acid, caprilic acid, laurinic acid, palmitic acid, stearic acid, aracinic acid, behenic acid, oleic acid, linolic acid, etc., saturated or unsaturated, medium to high homologous order aliphatic acids.

Regarding the esterification, it is sufficient if it is conducted on part of the hydroxyl radicals of the alcohol, however even when the number of the free hydroxyl radicals is decreased, and it becomes difficult to be dissolved in water, it can be used as it is dispersed in the water.

(Immersion Method)

The above described aliphatic acid ester is used in a state where depending on the goals, one type is used, or two or more types are combined, and it is employed in a state as an aqueous solution or an aqueous dispersion, and its concentration is usually, in the range of 0.01 ~ 10 %, and preferably, it is in the range of 0.1 ~ 2 %. If the concentration becomes higher than 10 %, there is the risk of generation of spray injury (chemical injury), and the viscosity of the solution or the dispersion becomes too high, and the use also becomes impossible. Because of the fact that it becomes difficult for the chemical agent to dry, there is the possibility of the generation of mold (mildew). In the case when the concentration used is less than 0.01 %, the chemical agent becomes ineffective.

Regarding the immersion temperature, it is preferred to be in the range of 40oC ~ 60oC, and in the case when it is less than 40oC, there is no complete elimination of the black spot decease, and if the temperature exceeds 60oC, because of the fact that there is a destruction of the physiologically active materials inside the mangos, for example, vitamins, etc., it is necessary that the range be limited to the temperature range of 40oC ~ 60oC. Regarding the time duration of the immersion, it depends on the concentration of the used chemical agent, and depending on the size of the mangos it also varies, and it cannot be specified.

(Preparation of the immersion solution)

At the time of the preparation of the aliphatic acid ester aqueous solution or aqueous dispersion according to the present invention, in the case of a single aliphatic acid ester aqueous solution or aqueous dispersion, it is a good option if simply the above ester material is dissolved or dispersed in water. However, in the case when an aqueous solution or an aqueous dispersion of a composite composition is to be prepared, it is a good option if the material obtained as the two or more types of polyvalent alcohol aliphatic acid esters are melted and mixed in advance, and this material is then pulverized and it is dissolved or dispersed in water, or it is a also a good option if the powder materials of the predetermined aliphatic acid ester materials, are mixed and this is then dissolved or dispersed in the water. Also, finally, regarding the method how it is made to be an aqueous solution or an aqueous dispersion at a temperature in the range of 40oC ~ 60oC, the method where the aliphatic acid ester is added in warm water, or the method where after the aliphatic acid ester is added, then it is heated, and the method where these are conducted at the same time, can be considered. However, among the polyvalent alcohol aliphatic acid esters according to the present invention, there are materials that when they are dissolved or dispersed in warm water they adhere onto the mangos, and for the homogeneous dissolution or dispersion a long time becomes necessary. And when this circumstance is considered, and also from the point of view of labor and time, there is no big difference between the three methods listed, the method where the aliphatic acid ester is added and after that it is heated, is preferred because of the fact that the possibility of the adhesion to the mangos is low. Moreover, in order to increase the stability properties of the aqueous solution or the aqueous dispersion, it is also possible to use together with that a stabilization agent

like sodium carboxymethyl cellulose, xantane rubber, guar rubber, sodium arginate etc.

[Effect]

According to the present invention, by using only a method where an aqueous solution or an aqueous dispersion of polyvalent alcohol aliphatic acid ester is heated to a temperature in the range of 40oC ~ 60oC, and the mangos are immersed, the mangos that are the subject of the treatment do not have a generation of the black spot decease, and the ripening is also slowed down, and the freshness state is preserved. It is supposed that probably the effect of the polyvalent alcohol aliphatic acid ester itself is due to the fact that a thin layer of it suppresses the breathing of the plant material and at the same time it eliminates the evaporation of the water content. However, the reason why by the combined use together with the warm water treatment which has an effect of eliminating the black spot decease, both the black spot decease elimination effect and the ripening slowing effect, are demonstrated is not completely clear at the present time. However, it is considered that by the heating condition, it becomes easy for the polyvalent alcohol aliphatic acid ester to physically adhered onto the surface skin of the mangos or to penetrate, and it is united with the effect according to the present invention.

At any rate, because of the fact that the method according to the present invention is a method that is simple, and also, there is capital used, it is an epoch-making technology, as a method for the preservation of the freshness of mangos. Moreover, it can be expected that the results according to the present invention are a significant improvement over the results obtained by the used according to the previous technology low temperature transportation and /or the combination with the-film packaging method.

[Practical Examples]

Here below, the present invention will be explained in further details by using practical implementation examples and reference examples, however, these examples are naturally used for explanation purposes only, and because of that they are not directly related to the technological scope of the present invention.

Practical Examples 1 ~ 4, Reference Examples 1 ~ 2

100 grams of each of the powder materials a ~ e; with the compositions described in the Table – 1, presented here below, were dissolved or dispersed in 10 liters of distilled water, and by that an aqueous dispersion or aqueous solution, were prepared. These materials were heated to a temperature of 52oC, and just harvested mangos were immersed for a period of 5 minutes. And after that, these were left to stay at a room temperature for a period of 36 hours, and after that, a VHT fumigation was conducted for a period of 6 hours. After that, these were stored under conditions at a temperature of 25oC and an RH in the range of 85 ~ 90 %. Moreover, as reference examples, materials are shown where in the above described treatment path, only the immersion treatment is modified, namely, in one case it is immersed only in warm water, and in the other case, it is not subjected to the immersion treatment at all.

These results are shown in Table –2.

According to the results from Table – 2, the mangos that have been immersed in the material obtained as the aqueous solution or aqueous dispersion of the polyvalent alcohol aliphatic acid ester according to the present invention, has been heated to a temperature of 52oC, almost at the 8th day become appropriately ripened. And contrary to that, the mangos that have been treated with warm water only, or the ones that have not been treated, become appropriately ripened at the 6th day, and because of that, it becomes clear that there is a ripening slowing effect. And then, compared to the case where there has been no treatment, conducted, there has been a decrease of the black spot decease, however, then, by the combined use of the polyvalent alcohol aliphatic acid ester according to the present invention, there was no generation of black spot decease at all.

Practical Examples 5, 6, Reference Examples 3, 4

The same way as in the case of the Practical Examples 1 – 4, by using the powder of the experimental material e, an aqueous solution was prepared. This material was maintained at various temperatures, and the mangos were immersed for a period of 5 minutes, and after that, the same procedures as those described according to the Practical Examples 1 ~ 4, were conducted.

These results are shown in the presented here below Table – 3.

According to the results presented in Table –3, if the mangos are treated within the temperature range according to the present invention, there is an appropriate ripening after the 8th day, and contrary to that, in the case when they are treated at a low temperature of 30oC, they become appropriately ripened after the 7th day. And also, if a treatment at a high temperature of 70oC is conducted, because of the fact that the living body system balance is destroyed, the phenomenon occurs where the surface skin of the mango is still the same green color as up to that pint, however, the inside part is ripened, and soft.

Clearly, it is understood that by the combined use of the 40oC ~ 60oC warm water treatment and the polyvalent alcohol aliphatic acid ester the effect of slowing the ripening is increased.

Table 1

Experimental Material	Components	Weight parts
A	Polysugar aliphatic acid ester	100
B	Glycerine monoaliphatic acid ester	100
C	Polyglycerine aliphatic acid ester	100
D	Polysugar aliphatic acid ester Sorbitane aliphatic acid ester	50 50
E	Polysugar aliphatic acid ester Glycerine aliphatic acid ester Sodium carboxy methyl cellulose	60 10 30

Table 2

	Chemical name	Eating feel and appearance	Number of storage days (days)	Number of storage days (days)	Number of storage days (days)	Number of storage days (days)	Number of storage days (days)	Number of storage days (days)	Number of storage days (days)	Number of storage days (days)
			1	2	3	4	5	6	7	8
Practical Example 1	a	Color	Green	Green	Green	Pale green	Part yellow	Half yellow	Large part yellow	All yellow
		Hardness	Very hard	Very hard	Very hard	Hard	Somewhat hard	Somewhat soft	Soft	soft
		Acidity	Extreme	Extreme	Extreme	There is	There is some	There is some	Almost none	none
		Black spot decease	None	None	None	None	None	None	None	None
Practical Example 2	b	Color	Green	Green	Green	Pale green	Part yellow	Half yellow	Large part yellow	All yellow
		Hardness	Very hard	Very hard	Very hard	Hard	Somewhat hard	Somewhat soft	Soft	soft
		Acidity	Extreme	Extreme	Extreme	There is	There is some	There is some	Almost none	none
		Black spot decease	None	None	None	None	None	None	None	None
Practical Example 3	c	Color	Green	Green	Green	Pale green	Part yellow	Half yellow	Large part yellow	All yellow
		Hardness	Very hard	Very hard	Very hard	Hard	Somewhat hard	Somewhat soft	Soft	soft
		Acidity	Extreme	Extreme	Extreme	There is	There is some	There is some	Almost none	none
		Black spot decease	None	None	None	None	None	None	None	None
Practical Example 4	d	Color	Green	Green	Green	Pale green	Pale green	Part yellow	Half part yellow	Large part yellow
		Hardness	Very hard	Very hard	Very hard	Hard	hard	Somewhat soft	Somewhat soft	soft
		Acidity	Extreme	Extreme	Extreme	There is	There is some	There is some	There is some	Almost none
		Black spot decease	None	None	None	None	None	None	None	None
Practical Example 5	e	Color	Green	Green	Green	Pale green	Pale green	part yellow	Half yellow	Large part yellow
		Hardness	Very hard	Very hard	Very hard	Hard	hard	Somewhat soft	Somewhat Soft	soft
		Acidity	Extreme	Extreme	Extreme	There is	There is some	Almost none	There is some	Almost none
		Black spot decease	None	None	None	None	None	None	None	None
Reference Example 1	Warm water treatment	Color	Green	Green	Part yellow	Part yellow	Half yellow	All yellow	All yellow	All yellow
		Hardness	Very hard	Very hard	hard	Somewhat soft	Soft	soft	Extremely Soft	Extremely soft
		Acidity	Extreme	Extreme	There is	There is some	Almost none	None	None	none
		Black spot decease	None	None	None	None	There is some	There is some	There is some	There is some
Reference Example 2	No treatment	Color	Green	Part yellow	Part yellow	half yellow	Large part yellow	All yellow	All yellow	All yellow
		Hardness	Very hard	hard	Somewhat soft	Somewhat soft	Soft	soft	Extremely Soft	Extremely soft
		Acidity	Extreme	There is	There is some	Almost none	none	None	None	none
		Black spot decease	None	There is some	There is some	There is some	There is some	There is	There is	There is

[Remark] The eating feel and the appearance were evaluated by a 5 member panel.

Table –3

	Treatment temperature	Eating feel and appearance	Number of storage days (days)	Number of storage days (days)	Number of storage days (days)	Number of storage days (days)	Number of storage days (days)	Number of storage days (days)	Number of storage days (days)	Number of storage days (days)
	(oC)		1	2	3	4	5	6	7	8
Practical Example 6	40	Color	Green	Green	Green	Pale green	Pale green	Part yellow	Half part yellow	All yellow
		Hardness	Very hard	Very hard	Very hard	Hard	hard	Somewhat soft	Somewhat soft	soft
		Acidity	Extreme	Extreme	Extreme	There is	There is some	There is some	There is some	Almost none
		Black spot decease	None	None	None	None	None	None	None	None
Practical Example 7	50	Color	Green	Green	Green	Pale green	Pale green	part yellow	Half yellow	all yellow
		Hardness	Very hard	Very hard	Very hard	Hard	hard	Somewhat soft	Somewhat Soft	soft
		Acidity	Extreme	Extreme	Extreme	There is	There is some	Almost none	There is some	Almost none
		Black spot decease	None	None	None	None	None	None	There is some	There is some
Reference Example 3	30	Color	Green	Green	Green	Pale green	Part yellow	Half yellow	All yellow	All yellow
		Hardness	Very hard	Very hard	Very hard	hard	Somewhat Soft	Somewhat soft	Soft	soft
		Acidity	Extreme	Extreme	Extreme	There is some	There is	Almost None	None	none
		Black spot decease	None	None	None	None	None	None	There is some	There is some
Reference Example 4	70	Color	Green	Pale green	Pale Green	Pale Green	Pale Green	Pale Green	part yellow	Part yellow
		Hardness	Somewhat soft	Somewhat soft	Soft	Soft	Extremely soft	Extremely soft	Extremely Soft	Extremely soft
		Acidity	There is	There is	There is some	There is some	There is some	There is some	There is some	There is some
		Black spot decease	None	None	None	None	None	None	There is some	There is some

[Remark] The eating feel and the appearance were evaluated by a 5 member panel.

[Results from the present invention]

Relative to the present invention, by the use of a method where an aqueous solution or an aqueous dispersion of a single polyvalent alcohol aliphatic acid ester or a combination of two or more types of those, is heated to a temperature in the range of 40 ~ 60oC, and the mangos are immersed, by that a further increase of the effect of the elimination of the black spot decease and an effect of slowing of the ripening, are shown, and excellent results for the preservation of the freshness of mangos, are demonstrated.

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